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INT CL[5] B08B 15/00, C23G 5/00

(54) Vapour or gas containing plant for cleaning

(57) A plant for solvent cleaning of articles is adapted to reduce the emission of vapour from a vessel 12 into which the articles are inserted for contact with the solvent. The vessel 12 is provided with a hood 10 which encloses the vessel opening 16 and has an opening 26 to allow access to the interior of the hood. A flexible door 28 is mounted on tracks for movement between a position in which it closes the vessel opening 16 to isolate the vessel interior from the surroundings while permitting access to the hood, and a position (as shown) in which it closes the opening 26 in the hood to isolate the interiors of both the hood and the vessel from the surroundings. A lift mechanism 18 is used to lower the articles in a detachable basket 20 into the vessel 12 where a heater vaporises the solvent which may be a chloro-hydrocarbon or a chlorofluoro-hydrocarbon. An extractor fan may be provided in the hood in association with the door 28 so as to automatically return vapour in a condensed form to the vessel. A viewing window 50 is also provided.

Fig.1.

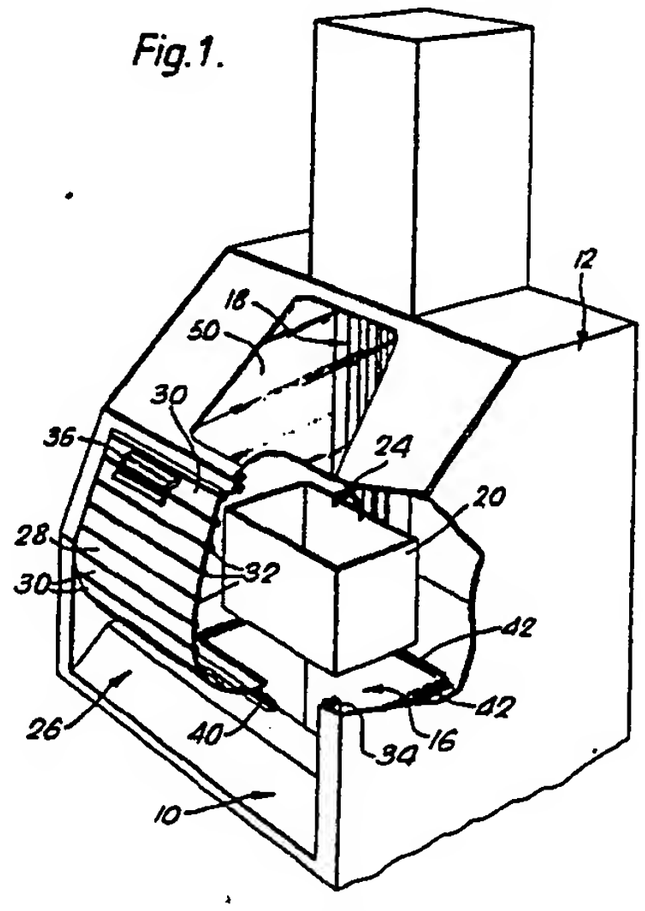

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Fig. 1.

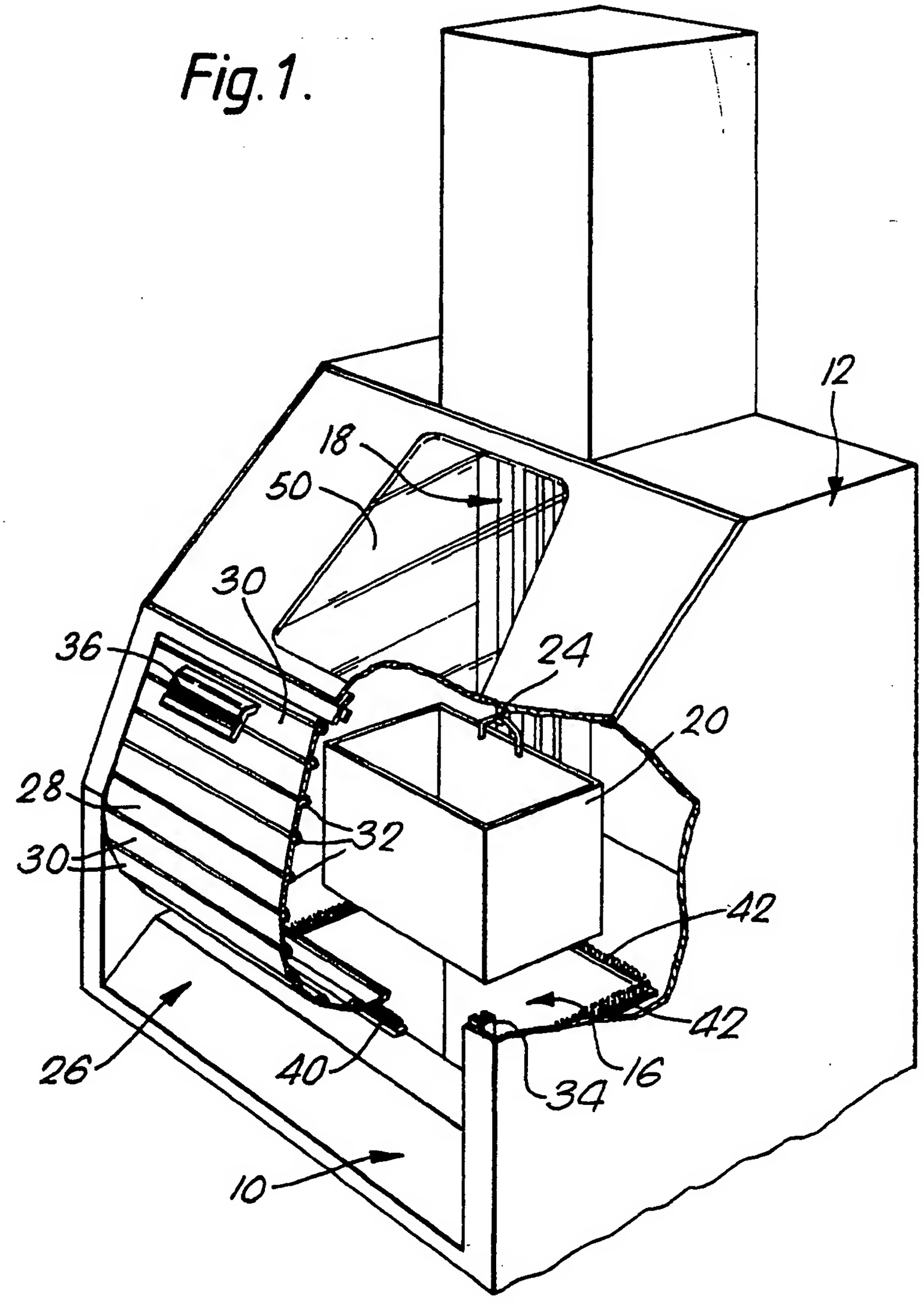

Fig. 2.

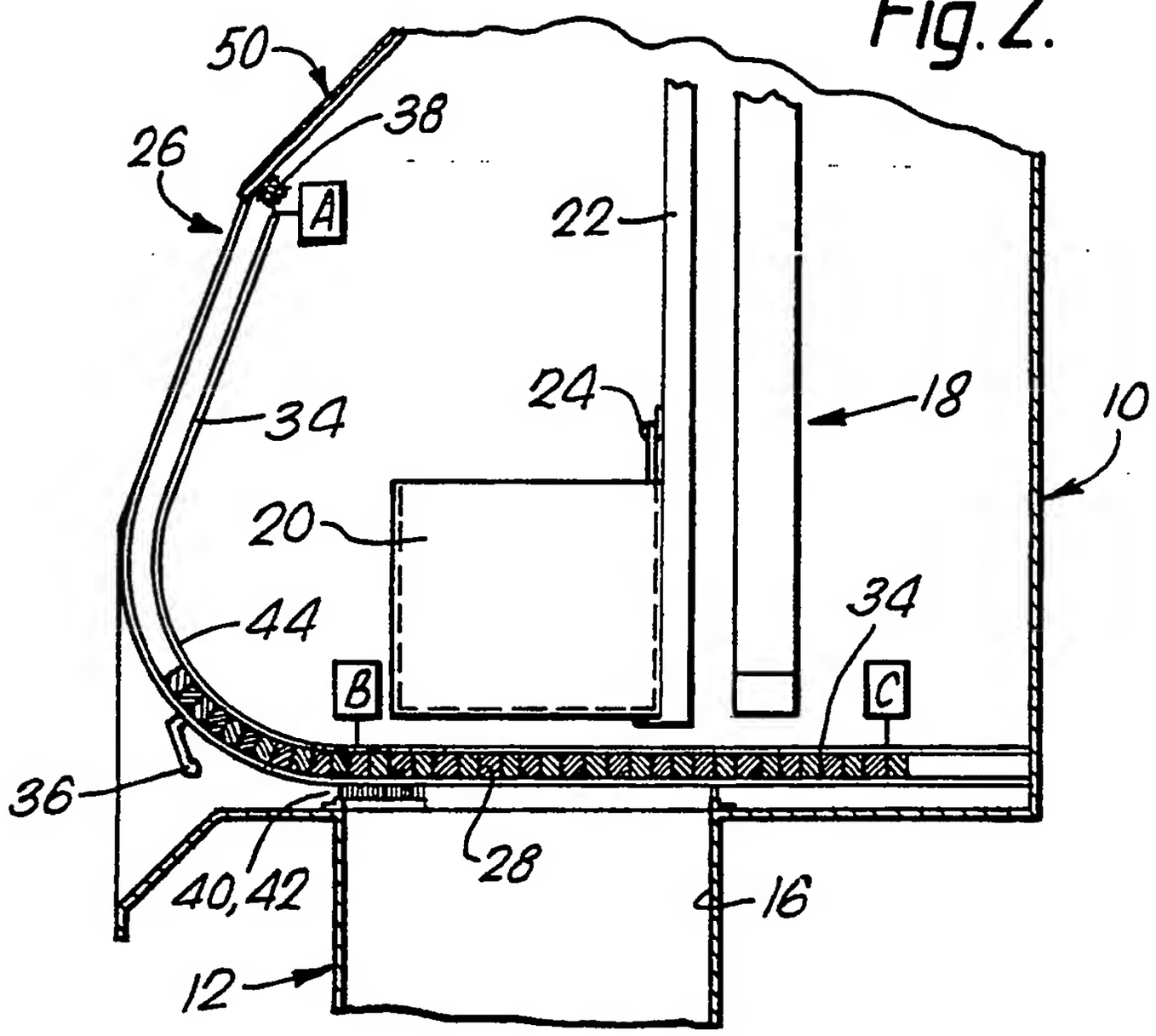
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Fig. 3.

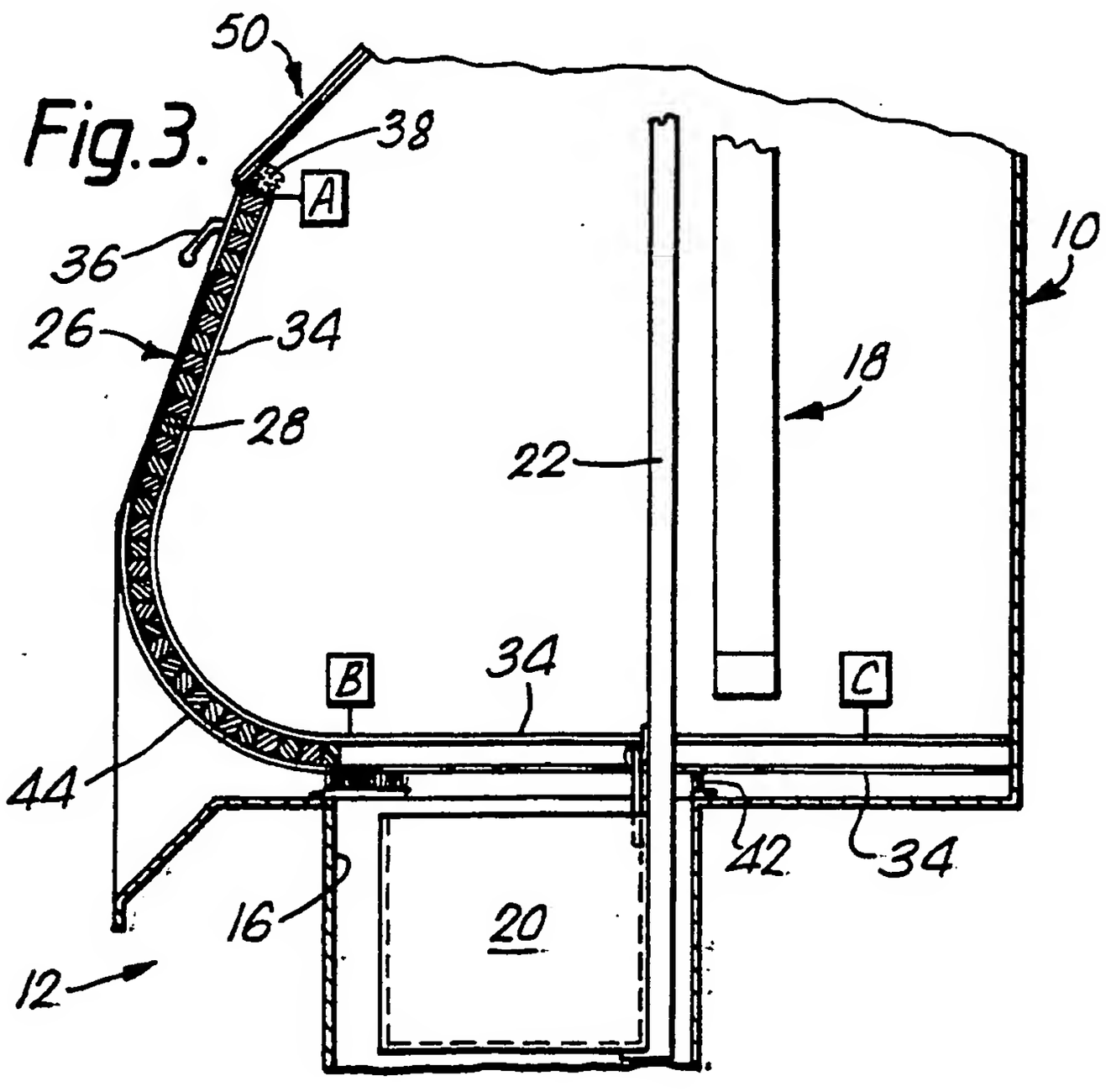
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Fig.4.

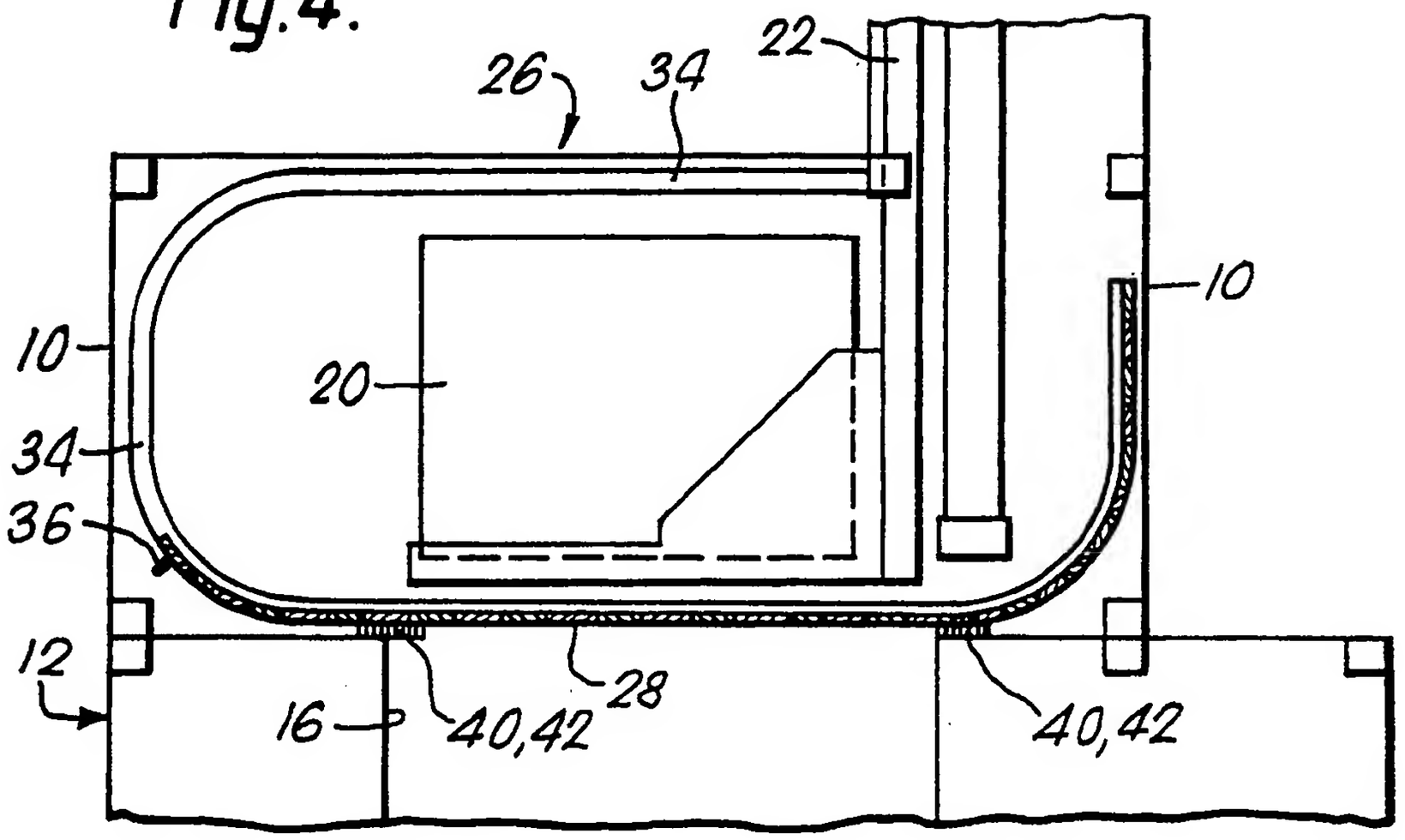
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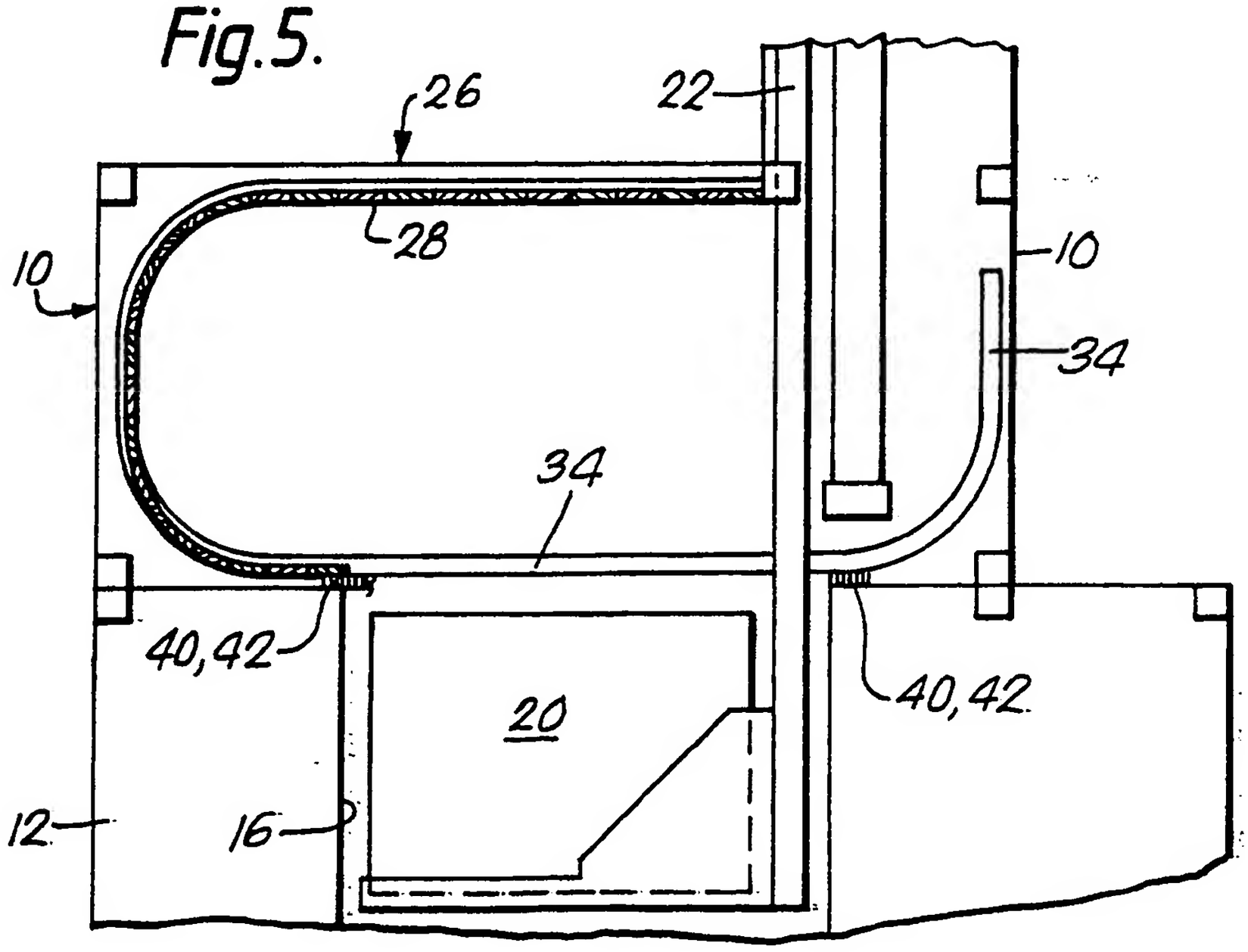
Fig.5.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VAPOUR OR GAS-CONTAINING PLANT

This invention relates to vapour or gas-containing plant and is particularly concerned with plant in which a vapour or gas-containing region of the plant is to be accessed. The invention has application for example to solvent cleaning plant in which a suitable solvent, usually a chloro-hydrocarbon or a chlorofluoro-hydrocarbon solvent (which may be mixed with co-solvents, eg. alcohols) is heated, often at the boil, and articles to be cleaned are immersed in the heated liquid solvent and/or in the vapour above the heated solvent to clean them. Typically, the solvent is vaporised and allowed to condense on relatively cold articles to dissolve any grease or like solvent-soluble contaminants on the articles and flush away any other contaminants such as dirt, swarf or the like.

Solvent cleaning plants generally comprise a tank for containing liquid solvent and having an opening for insertion and withdrawal of articles to be cleaned, means for heating the liquid solvent in the tank and means adjacent the opening for cooling solvent vapour within the tank to limit the emission of vapour, generated by heating of the liquid solvent, to the surroundings. Liquid solvent resulting from condensation of the vapour by the cooling means and by the articles to be cleaned (when immersed in the vapour) is usually returned directly to the main body of liquid solvent within the tank.

Increasing concerns about the possible health hazards of solvent vapour emissions and their possible effect on the ozone layer have highlighted the need to confine cleaning plant vapours to the plant.

It is known to provide a closure member in association with the insertion/withdrawal opening of the tank so that the opening need only be open to the

atmosphere during insertion or withdrawal of the articles. It is also known to construct the closure member as a sliding component so that the act of opening and closing it by sliding motion across the opening does not tend to create a pressure effect which could otherwise induce emission of vapour from the opening of the tank.

Despite the above measures, which tend to reduce the emission of vapour from the plant into the atmosphere, the fact that the opening is periodically open to the atmosphere, during insertion and withdrawal of the articles undergoing cleaning, gives rise to the possibility of emission into the atmosphere. The present invention therefore seeks to further reduce the risk of emission.

According to the present invention there is provided plant comprising a vessel for containing a gas or vapour, a first access opening in the vessel, an enclosure enclosing the first access opening so that any gas or vapour emitted from the vessel through the the first opening enters the enclosure, a second access opening in the enclosure, and a closure member movable between a first position in which it closes the second opening and thereby substantially isolates the interiors of the enclosure and the vessel from the surroundings, and a second position in which it closes the first opening to substantially isolate the vessel interior from the interior of the enclosure without restricting access to the interior of the enclosure through the second opening.

Preferably the enclosure contains means for transferring articles to be treated (by exposure to the vapour or gas or by immersion in a body of liquid from which the vapour or gas is generated) into the vessel, such means being operable to convey the articles

through the first opening when the closure member is in the first position and being accommodated within the enclosure when the closure member is in the second position.

Preferably the openings lie in angularly related planes and the closure member is guided for movement between the first and second positions by track means including a curved section to re-orientate the closure member as it moves from one position to the other.

The closure member is conveniently mounted for sliding movement along the track means, the closure member being of deformable construction to enable it to conform to curved and linear sections of the track means.

The track means may comprise first and second linear sections for constraining at least part of the closure member in a generally planar configuration when the closure member occupies each of the respective linear sections, the linear sections being separated (in the direction of movement of the closure member) by the curved section and being associated with the first and second openings respectively.

The first opening is conveniently bordered around its periphery by sealing means with which the closure member makes sealing contact when in the second position and the sealing means is advantageously arranged so that, when the closure member is in the first position, part of the sealing means for the first opening contacts the closure member to provide sealing around part of the periphery of the second opening.

The closure member conveniently comprises a series of hingedly connected elements to enable it to be deformed by co-operation with the track means and thereby assume a planar or curved configuration

according to the section of the track means occupied by the closure member.

Each of the hingedly connected elements preferably has a planar face on one side with hinged connections located on the opposite side so that, when the closure member is in one or other of the first and second positions, at least those elements extending across the opening which is closed have their planar faces presented towards the opening and in substantially coplanar relation without any intervening projections, the hinged connections being arranged to project inwardly with respect to the interior of the enclosure.

In one embodiment of the invention, the enclosure accommodates a conveying mechanism and a article-receiving carrier for movement between the enclosure and the vessel by means of the conveying mechanism, interlock means being associated with the closure member in such a way that the mechanism can only be operated to move the carrier into the vessel when the closure member has been moved to the first position.

As an additional measure, extraction means may be associated with the enclosure to exhaust any vapour or gas from the enclosure when the closure member is moved from the first position to the second position, the extraction means preferably being operable automatically in response to movement of the closure member into the second position. The extraction means may be arranged so as to recycle the extracted vapour back to the vessel, eg. after it has been condensed, so as to avoid emission into the surroundings.

The invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a perspective view, partly broken away to show internal details, of the hood unit of a solvent vapour cleaning;

Figure 2 is a schematic sectional view showing the interior of the hood, the two-way door of the hood being shown diagrammatically in one of its closure positions;

Figure 3 is a similar view to that of Figure 2 but with the door shown in its other closure position; and

Figures 4 and 5 are views similar to those of Figures 2 and 3 for an alternative embodiment.

Referring to Figures 1 to 3, Figure 1 shows a hood unit 10 mounted above a tank 12 (only the top of which is shown) having an upwardly presented access opening 16 bordered by a brush seal. Although not shown in the drawings, the tank has a sump at the bottom for containing liquid solvent, a heater in the sump for vaporising the liquid solvent and cooling coils around the inside of the top portion of the tank in close proximity to the access opening 16 to condense and thereby contain the vapour emitted by the heated solvent.

Workpieces to be degreased by exposure to the vapour atmosphere within the tank are lowered from a loading station, as shown in Figure 2, into the tank (see Figure 3) by means of a lift mechanism 18 having a detachable basket 20 containing the workpieces. The lift mechanism 18 is housed within the hood unit 12 and may comprise a double-acting, pneumatic piston and cylinder assembly, the moving part 22 of which is provided with an attachment means 24 for mounting of the basket 20. After adequate exposure to the solvent vapour, the basket 20 is raised back into the hood unit

12 where it is accessible to the operator via an access opening 26 in the front wall of the unit.

The access openings 16 and 26 are controlled by a door assembly 28 which is movable between a first position as shown in Figure 3 and a second position as shown in Figure 2. In the first position, the door 28 closes the access opening 26 and thereby substantially isolates the interiors of both the hood unit 12 and the tank 10 from the surroundings so as to prevent emission of vapour from the plant. In the second position, the door 28 closes the opening 16 thereby isolating the interior of the tank 10 from the surroundings while permitting the operator access to the interior of the hood unit 12 via opening 26. Thus, with the door in the latter position, the operator can detach the basket from and re-attach it to the lift mechanism without being exposed to vapour emissions from the tank 10. With the door in the position shown in Figure 3, the lift mechanism can be used to lower and raise the basket into and from the tank without permitting release of vapour into the surroundings. The door may be retained in this position by releasable catches (not shown).

The door assembly 28 is of a roller shutter type and comprises a series of extruded aluminium slats 30 having integral spines and knuckles which interfit to provide hinged connections 32 between adjacent slats. In this way, the slats at each end thereof are each fitted with plastic end caps (not shown) which are received in channel section guide tracks 34 and act as bearings to allow relatively low friction sliding movement of the door along a path of travel defined by the tracks 34. The door has handles 36 to enable the operator to effect such movement of the door.

The end caps, in addition to acting as bearings, also serve to provide a measure of sealing between the door and the tracks and thereby constitute part of the sealing arrangement for the opening 26 when the door is in the position shown in Figure 3. In practice, the sealing provided by the end caps has been found to be adequate but, if necessary, further sealing measures may be taken in order to prevent release of vapour via any gaps between the door and the track. When the door is in the position shown in Figure 3, a seal between the opening 26 and the top edge of the door is provided by a strip 38 which may comprise a resiliently deformable closed cell foam material. In this position, the lower border of the opening 26 is sealed by contact of the front face of the door with a brush seal 40 which extends the full width of the opening 26 and, for part of its length, also borders the opening 16. Although in this position, the door in effect contacts a seal associated with the opening 26, it will be seen that this seal is achieved without the door impeding access to the tank.

The remainder of the opening 16 is bordered by brush seals 42 which are contacted by the front face of the door when the latter is in the position of Figure 2. The tracks 34 will be seen to comprise linear sections separated by a curved section 44 which can be readily negotiated by the door because of its hinged construction. The slats 30 are so arranged that the hinged connections 32 are presented inwardly of the hood and the outwardly presented slat faces are planar without any intervening projections between them thus facilitating sealing contact with the brush seals 40 and 42. Because the movement of the door between its two positions is of a sliding nature, it will be appreciated that there is no significant pressure

differential created which could otherwise cause the vapour to be sucked out of the tank.

A number of interlocks are provided, at locations A, B and C, to ensure that the door is correctly operated. The interlocks may typically comprise limit switches or the like arranged to register the position of the door and they may be incorporated in an electrical circuit to control operation of the lift mechanism. For example, the arrangement may be such that the switches at locations A and B will only allow the operator to initiate operation of the lift mechanism if the door is registered as being in the position shown in Figure 3. In this way, if the operator inadvertently fails to pull the door fully to the position of Figure 3, with the consequence that there may be a gap through which vapour could escape, he will be unable to operate the lift mechanism and this in turn will draw his attention to the fact that the door is not properly closed. In addition or alternatively, this condition may be signalled to the operator by some form of visual and/or audible alarm. The warning signal may be delayed for a predetermined time interval so as to allow the operator reasonable time in which to move the door from the Figure 2 position to that of Figure 3.

Similarly to ensure that the door is correctly in position when the tank opening 16 is to be closed, signals provided by the switches at locations B and C may provide a warning signal if the door is not correctly positioned, for example within a predetermined time interval after being moved from the position of Figure 3. Operation of the switch at location C may, if desired, energise an extractor fan (not shown) to exhaust any vapour that may be present within the confines of the hood unit following a

treatment cycle, the exhausted vapour being removed in such a way as to avoid emission into the surroundings, eg. it may be condensed and returned to the tank. The hood unit 12 as shown includes a viewing window 50 to allow the operator to check that the treatment cycle is proceeding correctly.

From the foregoing, it will be seen that with the door in the positions of Figures 2 and 3, the solvent tank is substantially sealed off from the operator and the surroundings thereby reducing the problems associated with emission of the solvent vapour.

Referring to Figures 4 and 5, these show an alternative embodiment which is generally similar to that of Figures 1 to 3 and the same reference numerals are used to depict like parts. In the case of Figures 4 and 5, the access opening 26 for the hood unit 10 extends over the opening 16 of the tank 12 and the door 28 is guided by tracks 34 for movement along a path such that in the position of Figure 4, it closes the opening 16 while permitting access to the interior of the hood unit 10 via the opening 26, and in the position of Figure 5, it closes the opening 26 and thereby isolates the interiors of the hood unit and the tank from the surroundings.

CLAIMS

1. Plant comprising a vessel for containing a gas or vapour, a first access opening in the vessel, an enclosure enclosing the first access opening so that any gas or vapour emitted from the vessel through the the first opening enters the enclosure, a second access opening in the enclosure, and a closure member movable between a first position in which it closes the second opening and thereby substantially isolates the interiors of the enclosure and the vessel from the surroundings, and a second position in which it closes the first opening to substantially isolate the vessel interior from the interior of the enclosure without restricting access to the interior of the enclosure through the second opening.

2. Plant as claimed in Claim 1 including means for transferring articles to be treated (by exposure to the vapour or gas or by immersion in a body of liquid from which the vapour or gas is generated) into the vessel, such means being operable to convey the articles through the first opening when the closure member is in the first position and being accommodated within the enclosure when the closure member is in the second position.

3. Plant as claimed in Claim 1 or 2 in which the closure member is guided for movement between the first and second positions by track means including a curved section to re-orientate the closure member as it moves from one position to the other.

4. Plant as claimed in Claim 3 in which the closure member is mounted for sliding movement along the track means, the closure member being of deformable construction to enable it to conform to curved and linear sections of the track means.

5. Plant as claimed in Claim 3 or 4 in which the track means comprises first and second linear sections for constraining at least part of the closure member in a generally planar configuration when the closure member occupies each of the respective linear sections, the linear sections being separated (in the direction of movement of the closure member) by a curved section and being associated with the first and second openings respectively.

6. Plant as claimed in any one of the preceding claims in which the first opening is bordered around its periphery by sealing means with which the closure member makes sealing contact when in the second position.

7. Plant as claimed in Claim 6 in which the sealing means is arranged so that, when the closure member is in the first position, part of the sealing means for the first opening contacts the closure member to provide sealing around part of the periphery of the second opening.

8. Plant as claimed in any one of Claims 3, 4 and 5 or Claim 6 or 7 when appendant to any one of Claims 3, 4 and 5 in which the closure member comprises a series of hingedly connected elements to enable it to be deformed by co-operation with the track means and thereby assume a planar or curved configuration according to the section of the track means occupied by the closure member.

9. Plant as claimed in Claim 8 in which each of the hingedly connected elements has a planar face on one side with hinged connections located on the opposite side so that, when the closure member is in one or other of the first and second positions, at least those elements extending across the opening which is closed have their planar faces presented towards the opening

and in substantially coplanar relation without any intervening projections, the hinged connections being arranged to project inwardly with respect to the interior of the enclosure.

10. Plant as claimed in any one of the preceding claims in which the enclosure accommodates a conveying mechanism and an article-receiving carrier for movement between the enclosure and the vessel by means of the conveying mechanism, interlock means being associated with the closure member in such a way that the mechanism can only be operated to move the carrier into the vessel when the closure member has been moved to the first position.

11. Plant as claimed in any one of the preceding claims in which extraction means is associated with the enclosure to exhaust any vapour or gas from the enclosure when the closure member is moved from the first position to the second position, the extraction means preferably being operable automatically in response to movement of the closure member into the second position.

12. Plant as claimed in Claim 11 in which the extraction means is arranged so as to recycle the extracted vapour back to the vessel to avoid emission into the surroundings.

13. Plant substantially as hereinbefore described with reference to, and as shown in, either of the embodiments illustrated in the accompanying drawings.

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